

Tribal Science in Action:

Case Studies from Bois Forte Environmental Services' Indoor Air Quality (IAQ) Program



- 1) Pilot Project: Renovation of a home with **wet Preserved Wood Foundations (PWF)**
- 2) Using **blower door airtightness tests, infrared thermography, visual inspections and building code study** to diagnose construction flaws in new homes
- 3) Using **ultra-fine particle counting** to perform Environmental Tobacco Smoke (ETS) testing at Tribal casinos

2) Using blower door airtightness tests, infrared thermography, visual inspections and building code study to diagnose construction flaws in new homes





Residents complained of:

- 1) cold floors throughout the house**
- 2) cold bedrooms especially adjacent to the attached garage**
- 3) cold kitchens**
- 4) drafts entering the house around doors, windows and sliding glass doors**
- 5) cold air coming in through the range hood exhaust fan**

Several families reported going through an entire 300 gallon tank of propane in just over a month.

Some reported going through as many as five tanks over the entire heating season (at a cost of over \$500 per tank).



**Improved
heating,
insulating,
and
airsealing
by
residents**









**1) House closed up,
windows locked**

**2) Tectite System and
Pressure gauge attached**

3) House Depressurized

**4) Readings taken at 8
different pressures (50
down to 15 Pascals)**

5) Airleaks searched for



WIE DICHT IST IHR HAUS?

Stabiler,
verstellbarer
Aluminiumrahmen
mit umlaufendem
Dichtungsprofil.

Einzel kalibrierte
Meßgeräte für
Druckdifferenz und
Luftvolumenstrom.

Reißfestes
Gewebetuch für
den luftdichten Einbau
des Gebläses
im Türrahmen.

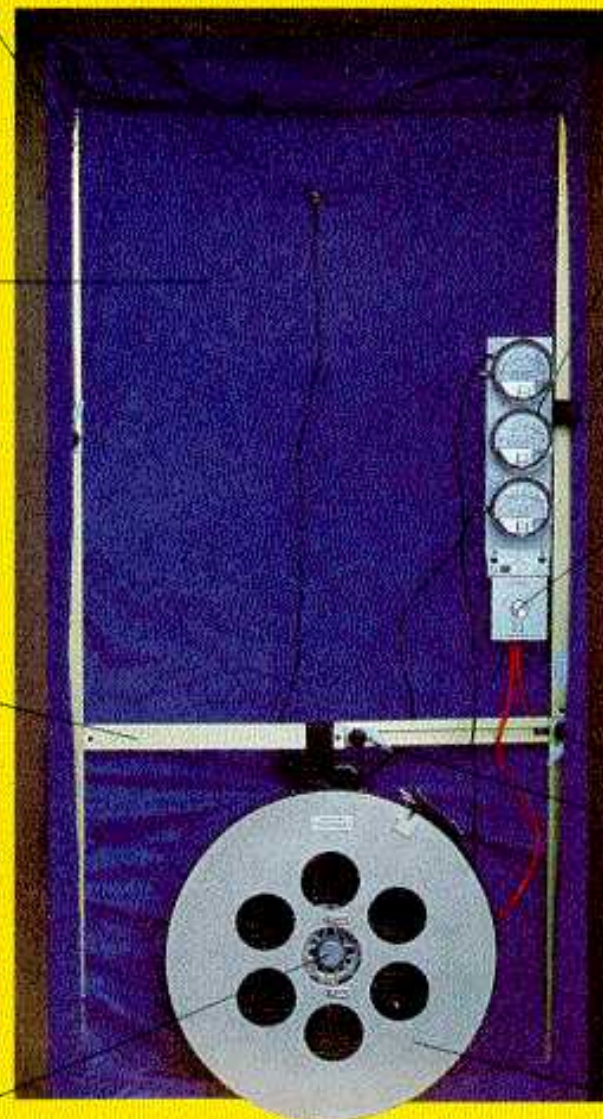
Elektronische
Drehzahlregelung
des Gebläses.

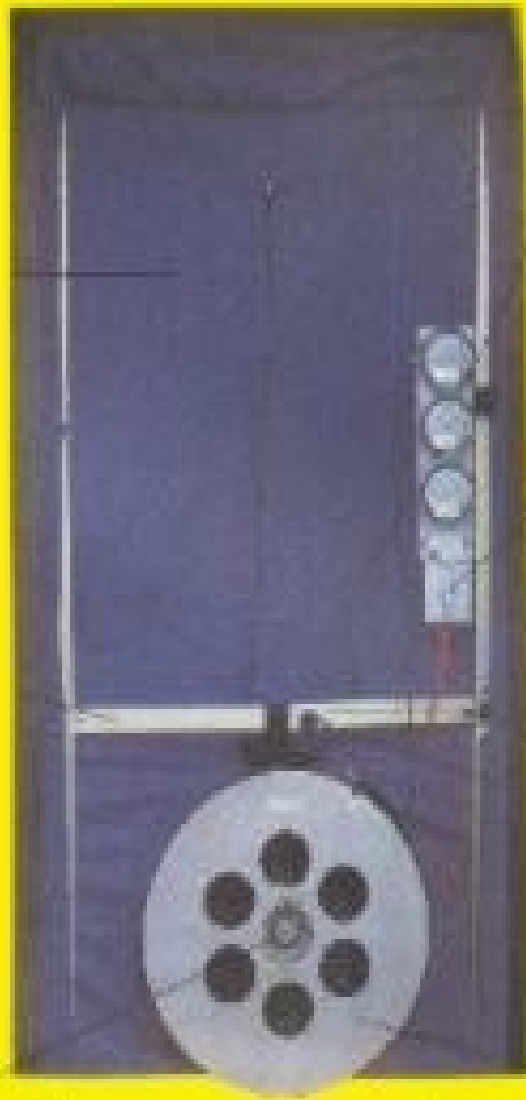
Querstrebe
zur Aussteifung
des Aluminiumrahmens.

Spannknebel
für rutsch- und kippfesten
Einbau des Türrahmens.

Hochleistungsgebläse
mit zwei Laufrichtungen
(1 Richtung kalibriert).

Meßblende
für Messungen
bei sehr kleinen Luftströmen.

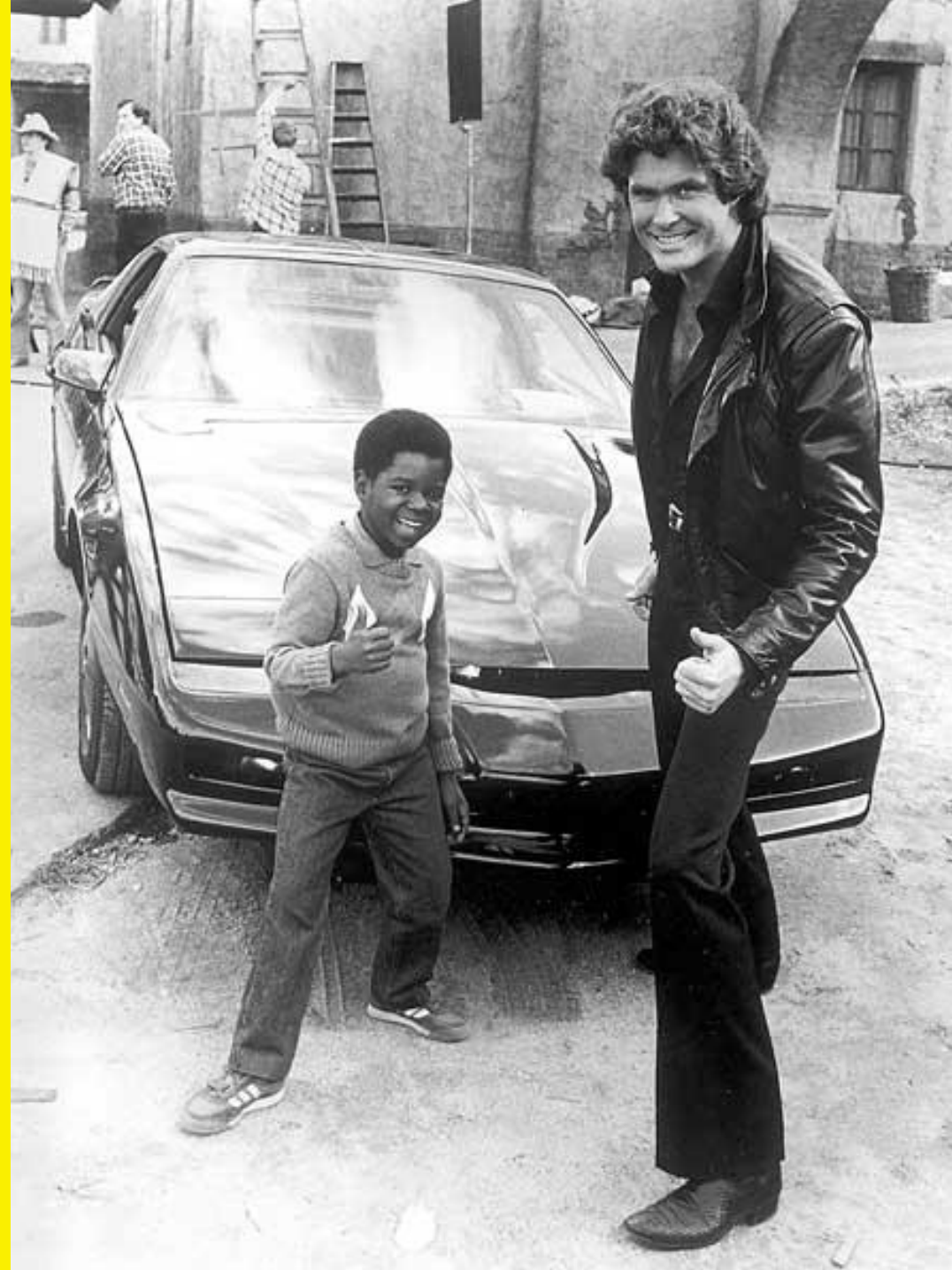




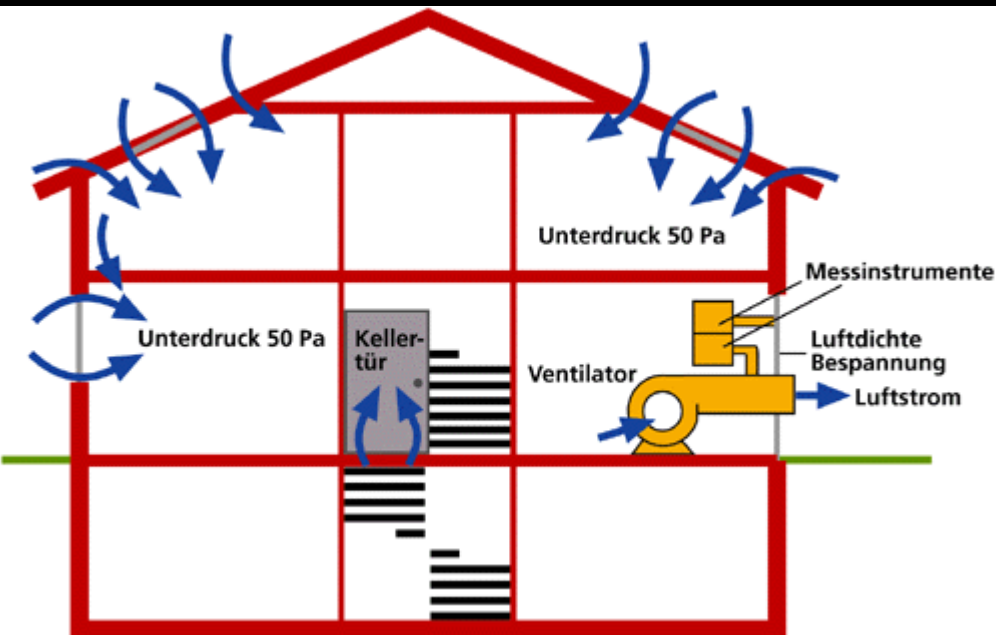
Meßgeräte

Gebläse

Meißblende



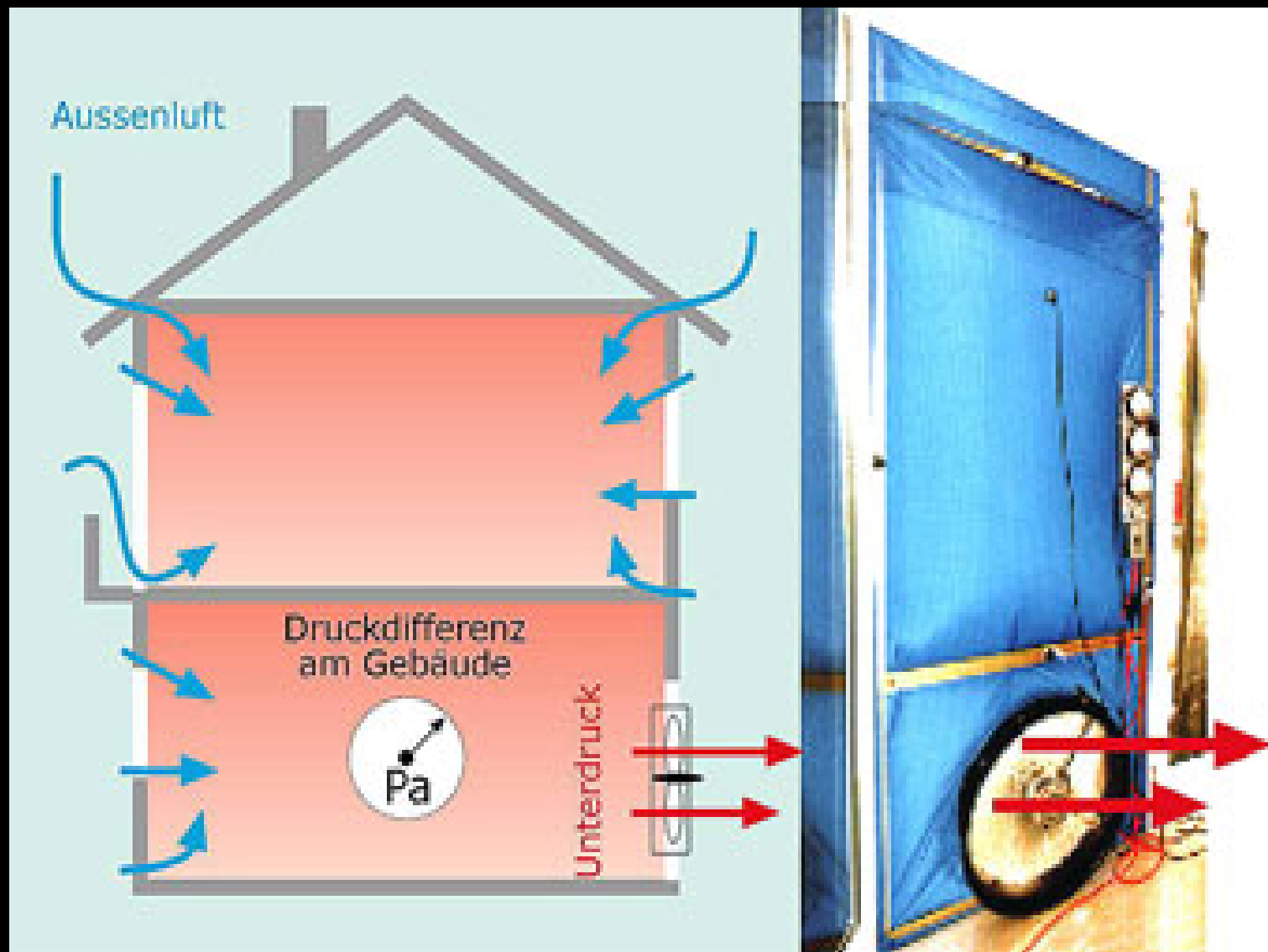




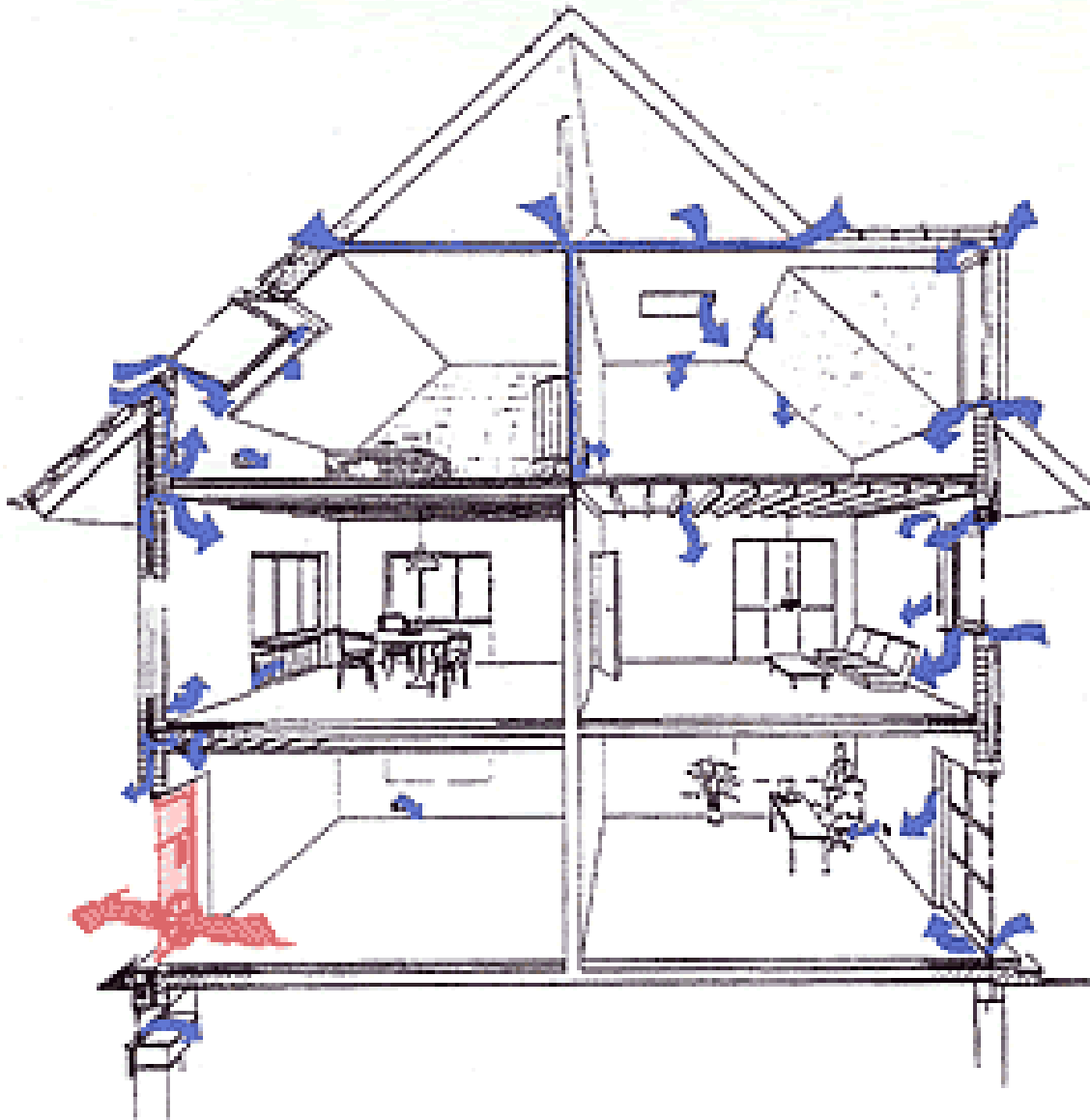
Blower-Door-Test

Besucher willkommen!

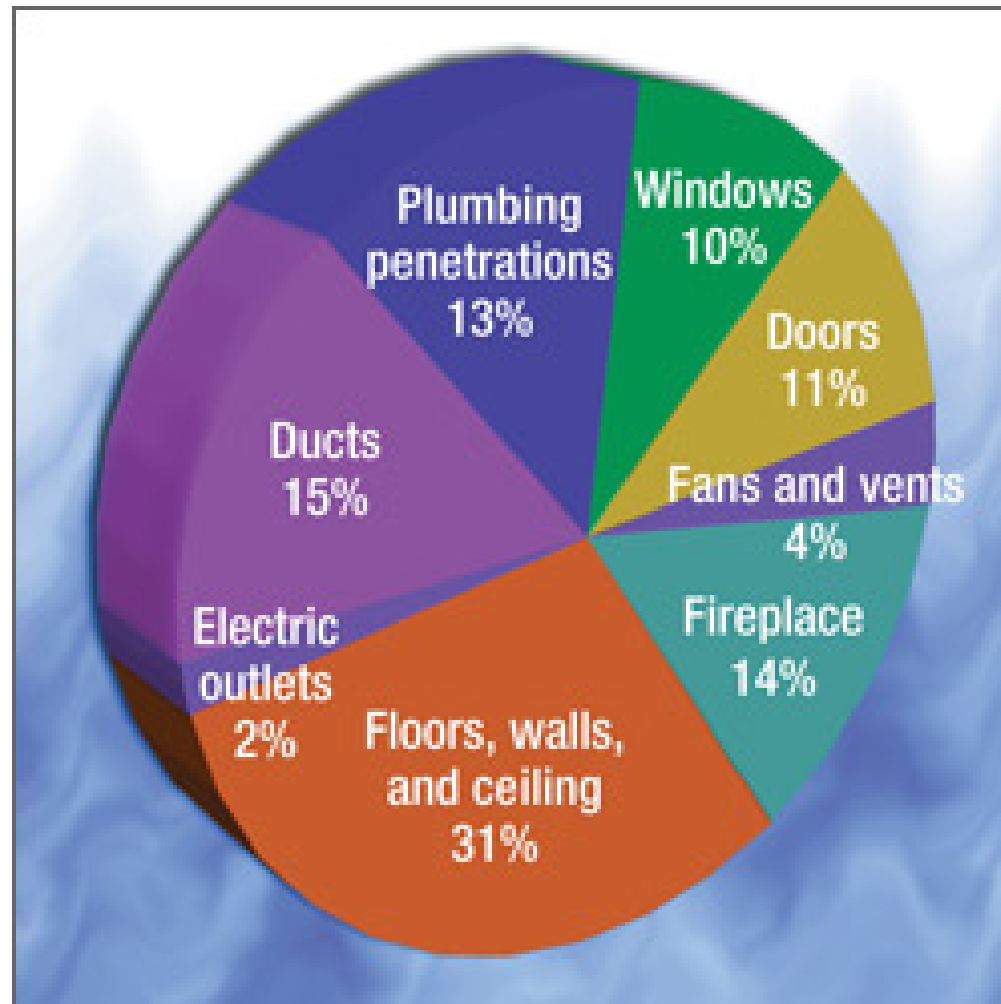
Termin:



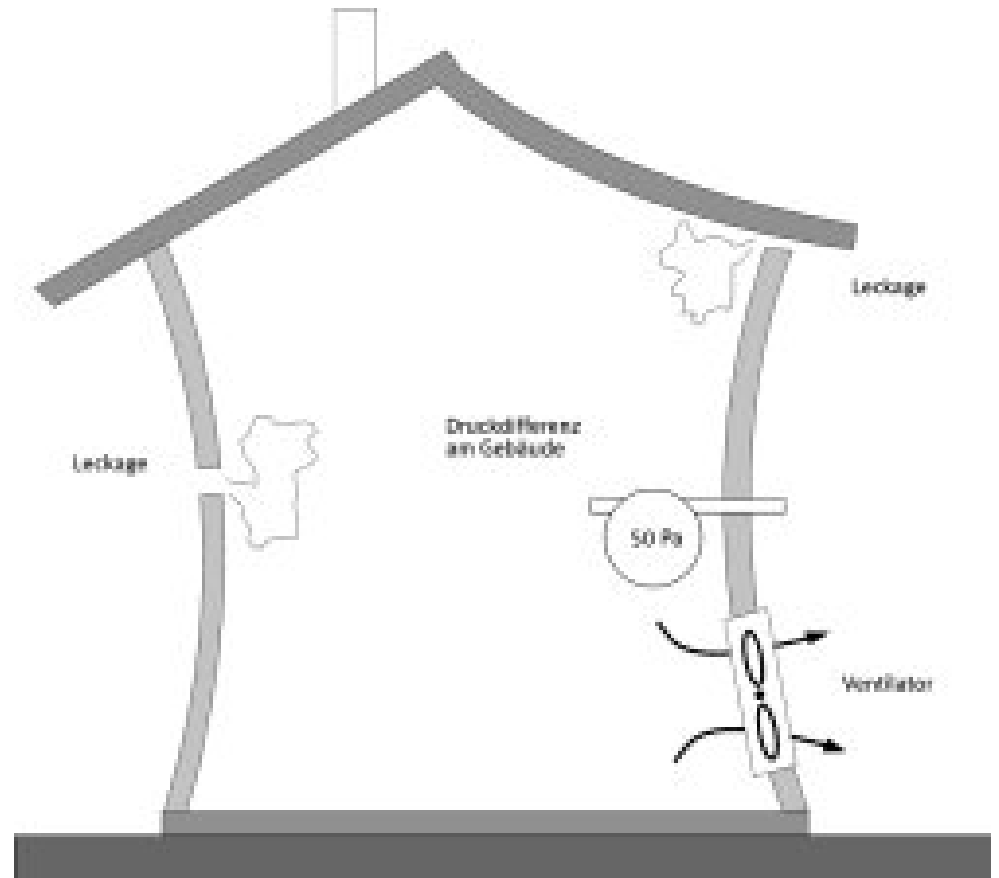
Major sources of airleakage in a home



- 1) Penetrations into attics
- 2) Top plates in attics
- 3) Around windows and doors
- 4) Air plenums
- 5) Around sill plates
- 6) Around electrical boxes

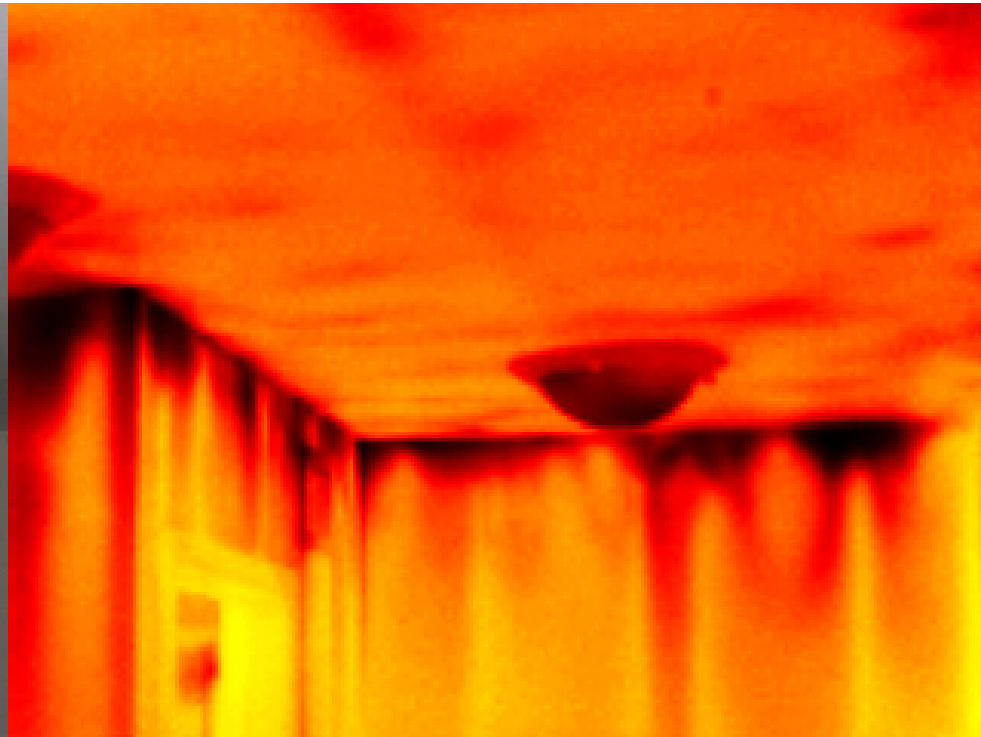


House under depressurization

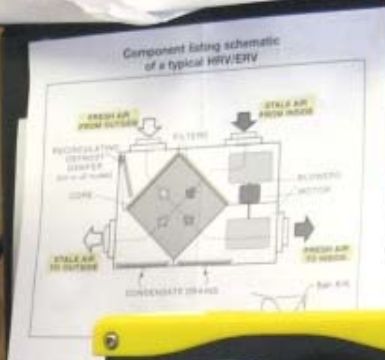




The search for airleaks begins...



Big Fort News Deadlines For 2006



Energy Design Conference & Expo

Elene Siny
Energy program

Darin Steen

Environmental Services Manager

Executive Title Council Phone: (714) 757-0642
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Services: • Solid Waste • Metals • Spill Response • HAZWOP • Remediation • Environmental Consulting & Safety

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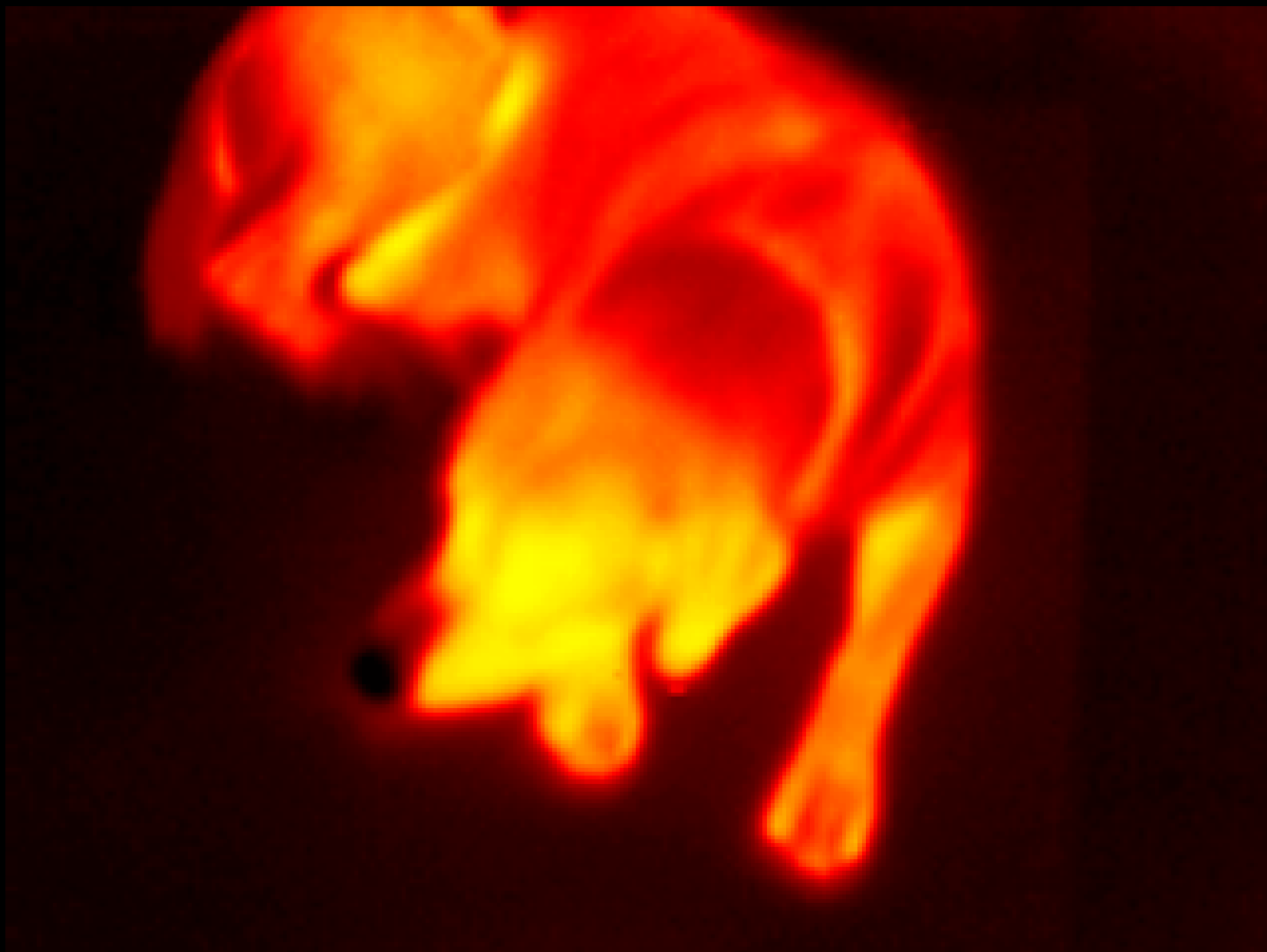
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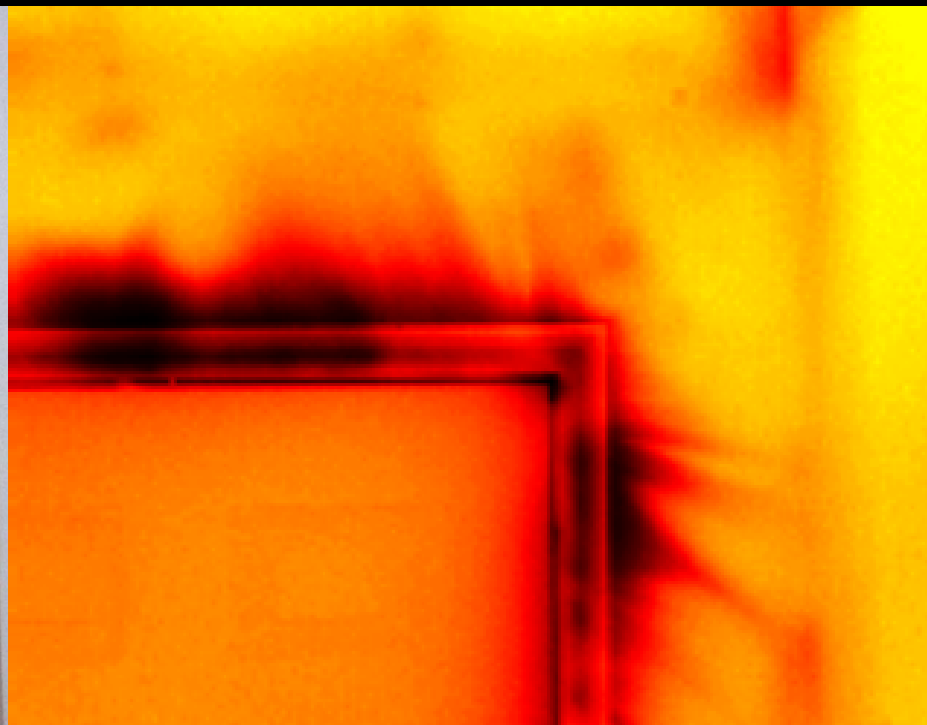
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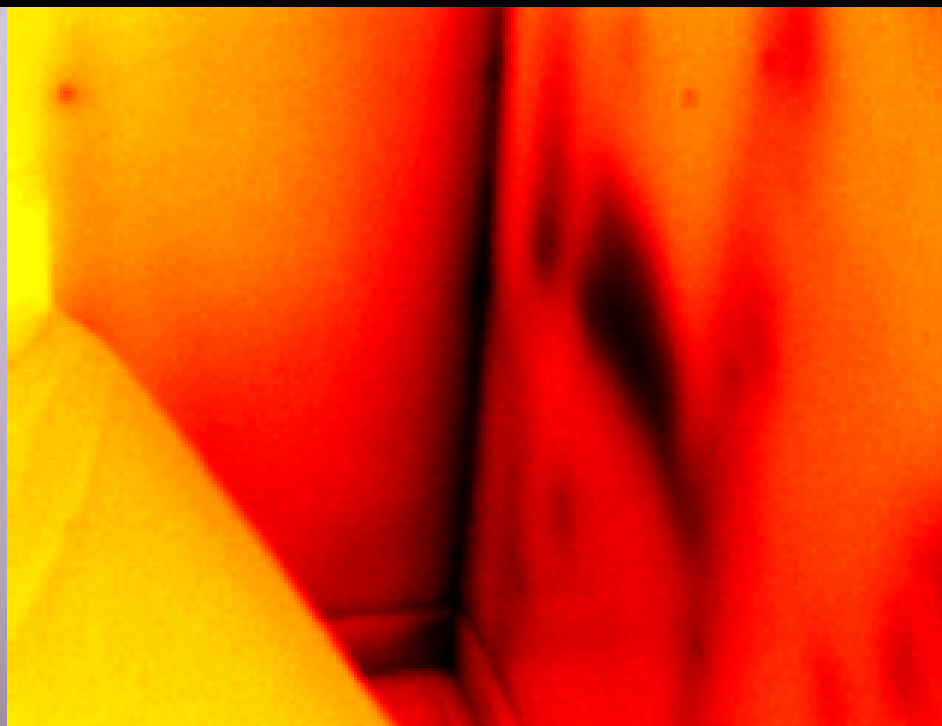
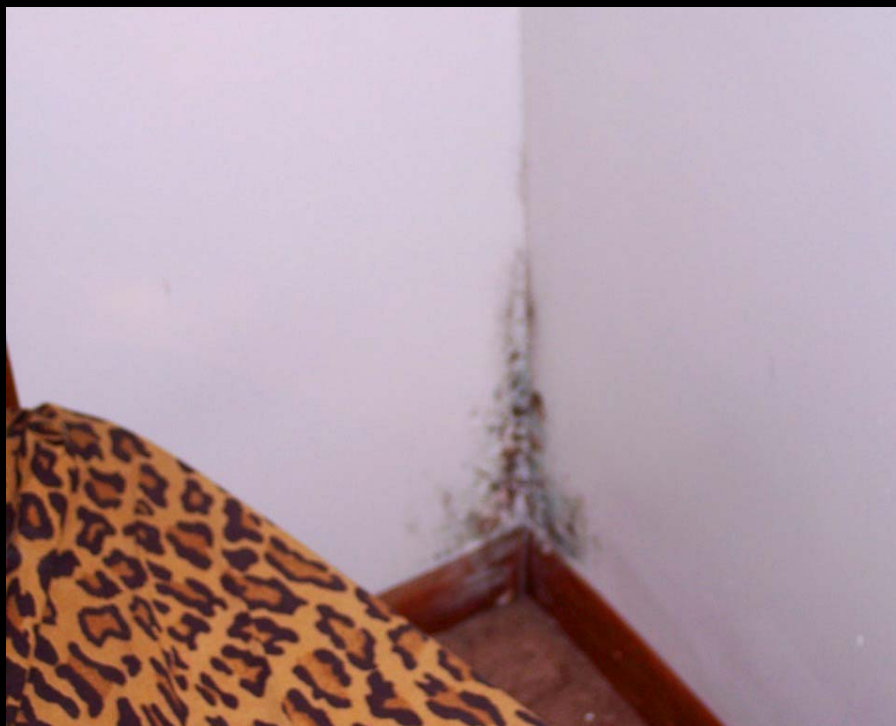
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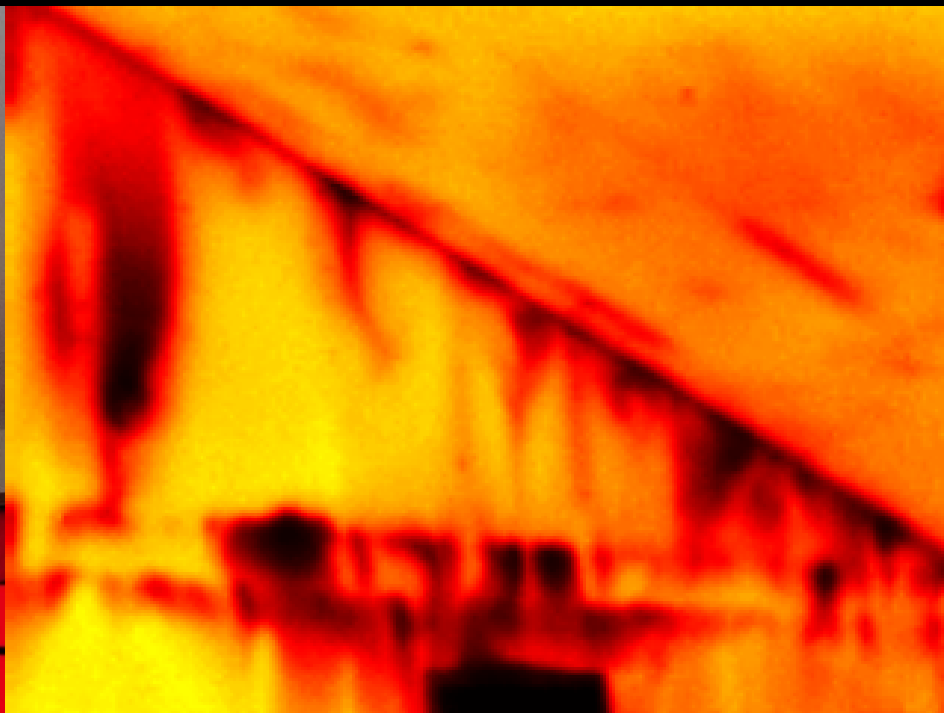
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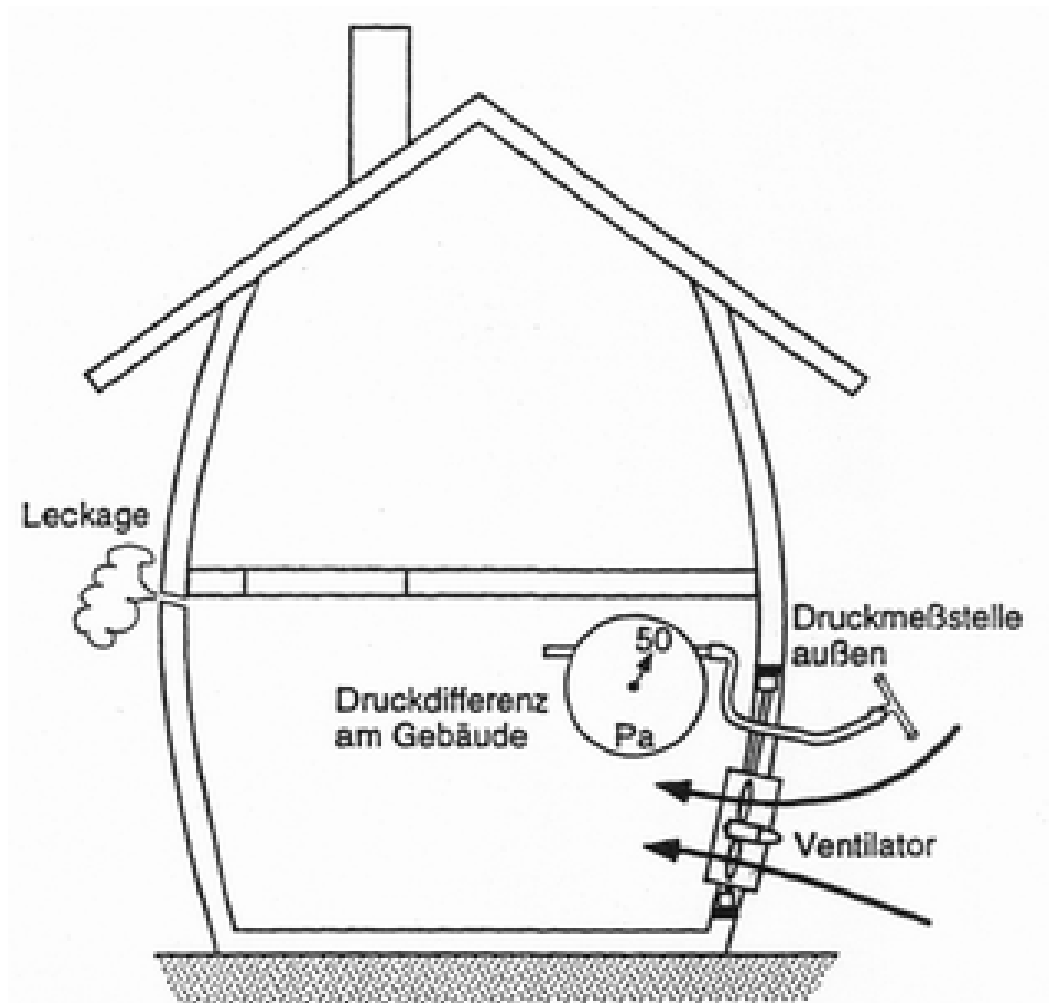
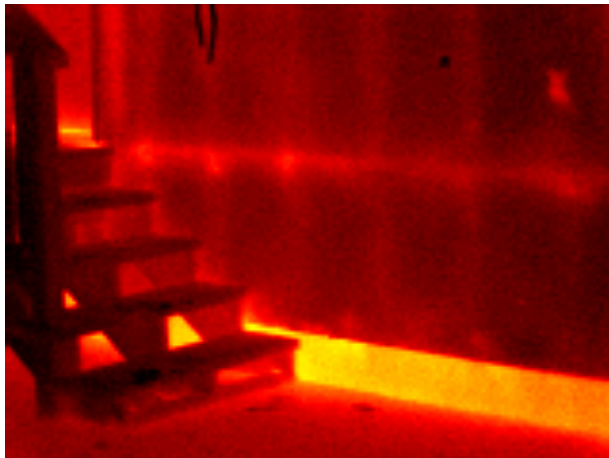




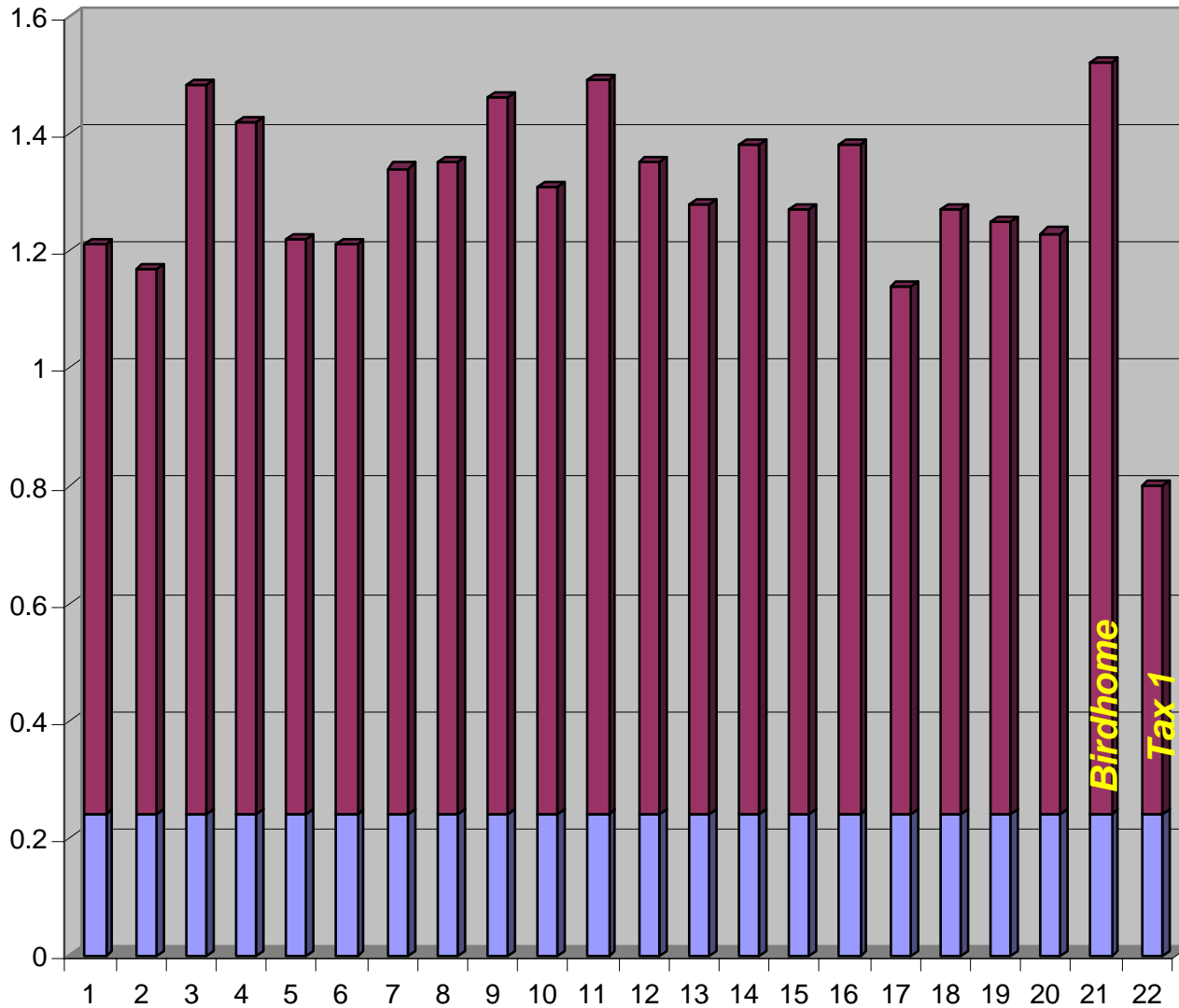




House under pressurization



Tax Credit 2 Homes

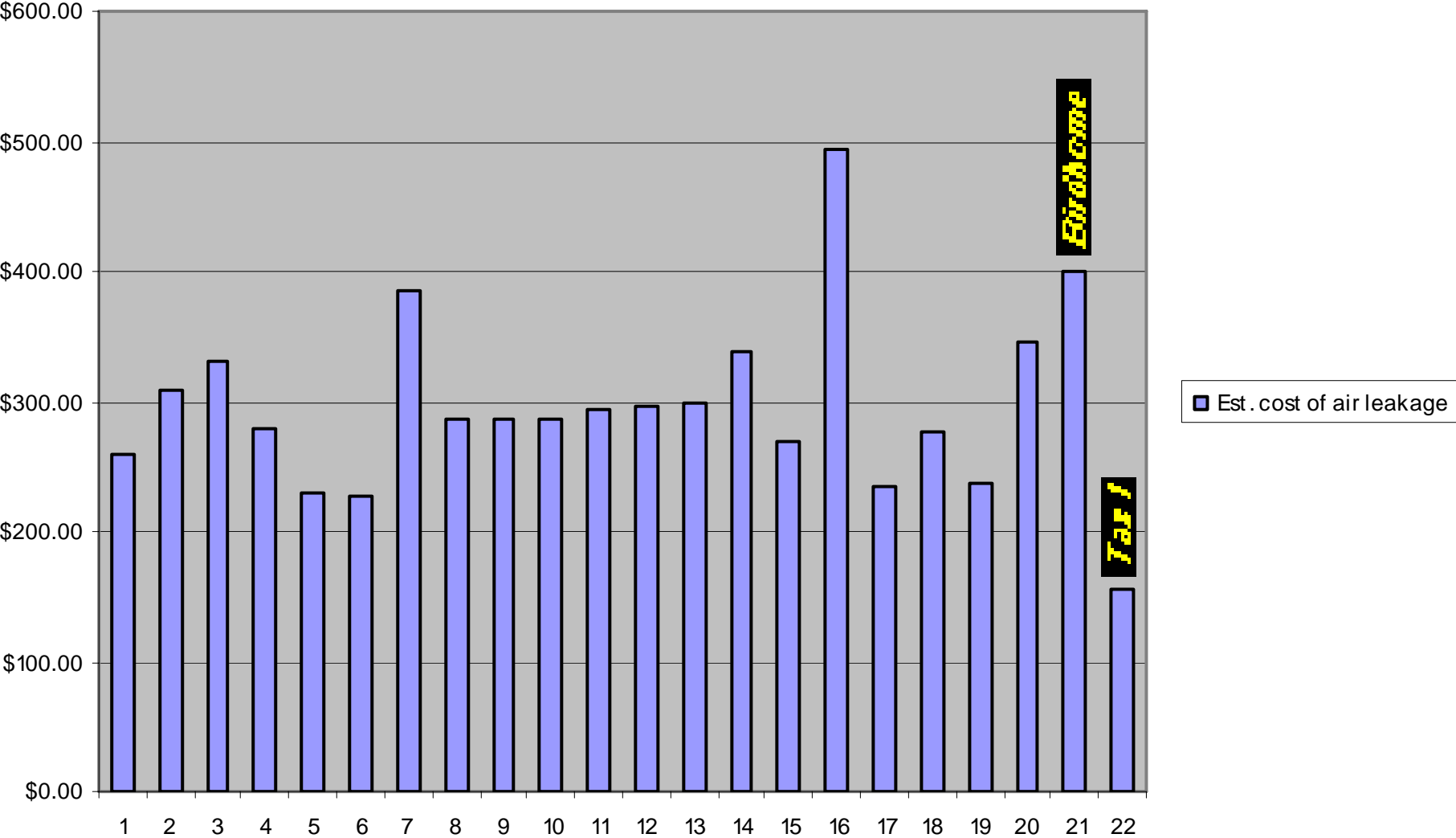


- CFM per ft2 floor area
- Code Baseline (.24)

Birdhome

Tax 1

Est. cost of air leakage



All 20 homes were found to have consistently poor airtightness values.

Compared to the airtightness portion of the Energy Code (adopted to the MN State Building Code April 15, 2000), the homes were all found to be between 3 to 5 times leakier than the building code allows.

Minnesota State Building Code & Energy Code - 2003

FARM PT. ROAD

MOLD - 2000

MN State Building Code Requirements

The energy portion of the Minnesota State Building Code has distinct ***prescriptive requirements*** for airsealing as well as a ***numerical airtightness standard***, one of which must be followed by residential building contractors:

Prescriptive Requirements:

In the MN State Building Code, Minnesota Rule 7670.0470, Subpart 7. Air Leakage, item B., (subitems 1 & 2), it states that all Category 1 buildings such as these ***“must be sealed around window and door frames, between wall cavities and window or door frames, and at utility penetrations”***.

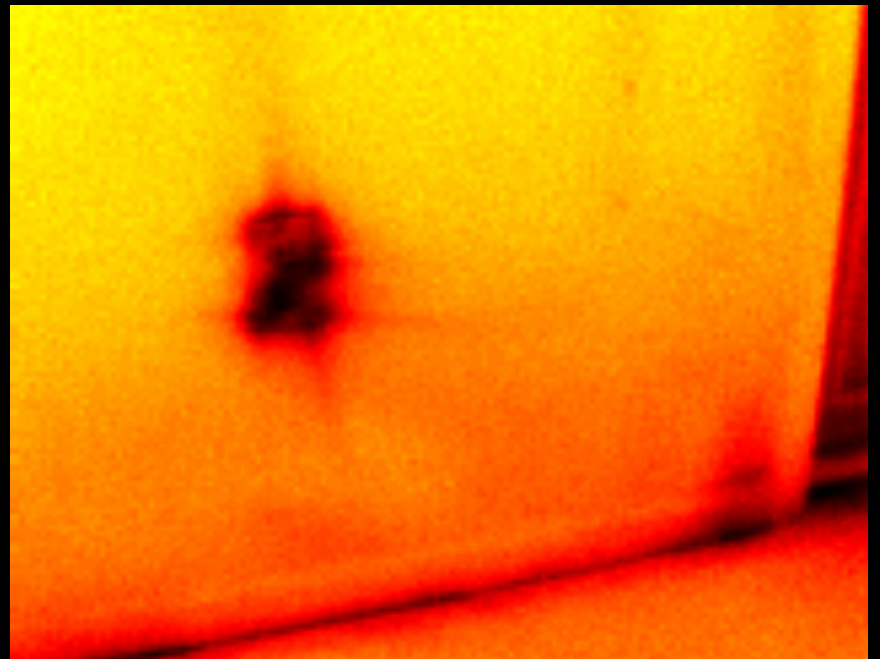
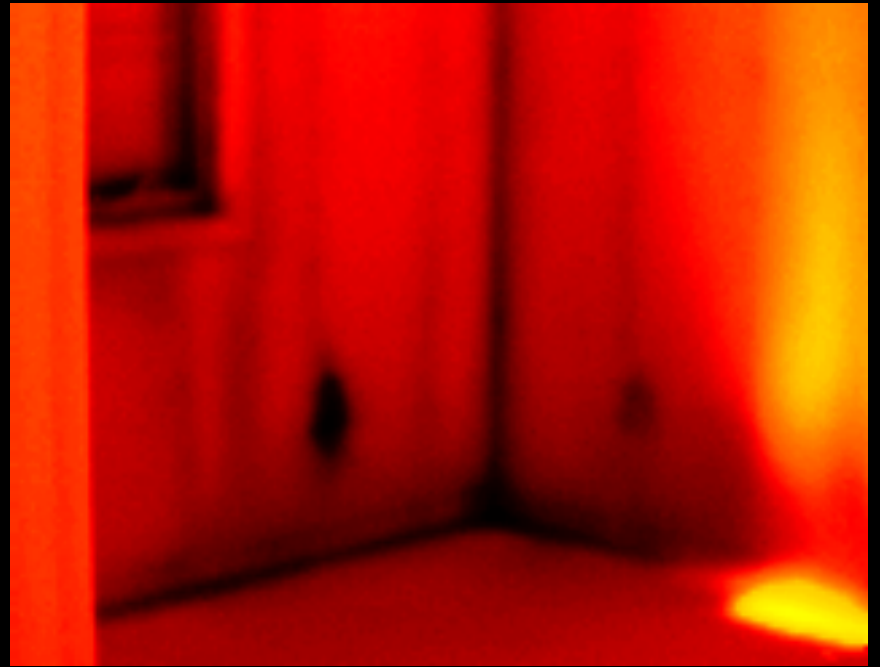
In addition, they must be sealed ***“between wall assemblies and their rim joists, sill plates, foundations; between wall and roof/ceilings; and between separate wall panels”***.

Numerical Airtightness Standard:

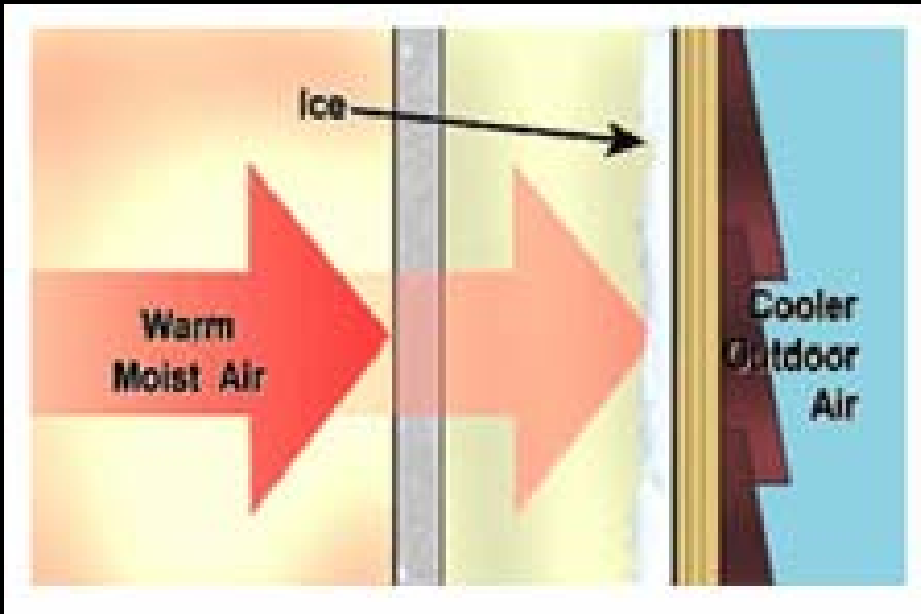
In Subpart 7. item C, they do allow for a “***performance alternative***” as an “***alternative to the prescriptive requirements of item B***”, in which case “***the air leakage rate must be 0.24 cubic feet per minute per square foot of conditioned space or less at 50 pascals***”.

Building Inspection Findings

1. Missing Insulation in the Crawl Space Walls	page 8
2. Missing Vapor Barrier in the Crawl Space Walls	page 9
3. Missing Insulation on Foundation Walls Above Grade	page 10
4. Missing Sheathing in Crawl Space Walls	page 12
5. No Air Sealing at Sheathing Penetrations	page 13
6. No Air Sealing at Top Plate of Walls	page 16
7. No Air Sealing at the Doors and Windows	page 17
8. No Air Sealing at the Sill Plate	page 18
9. No Sealing Behind Electrical Boxes	page 19
10. Poorly Installed Insulation	page 20
11. Covered Heat Registers (Missing Grilles)	page 21
12. Missing Heat Ductwork and Grilles	page 22
13. Missing Insulation, Duct Seal and Grilles, and Undersized Grilles	page 22
14. Poorly Installed Furnace Filters	page 24
15. Heat Recovery Ventilators Improperly Hooked Up	page 25
16. Incomplete Final Cleaning	page 27
17. Range Hood Exhaust Fans Improperly Installed	page 29



Moisture diffusion



















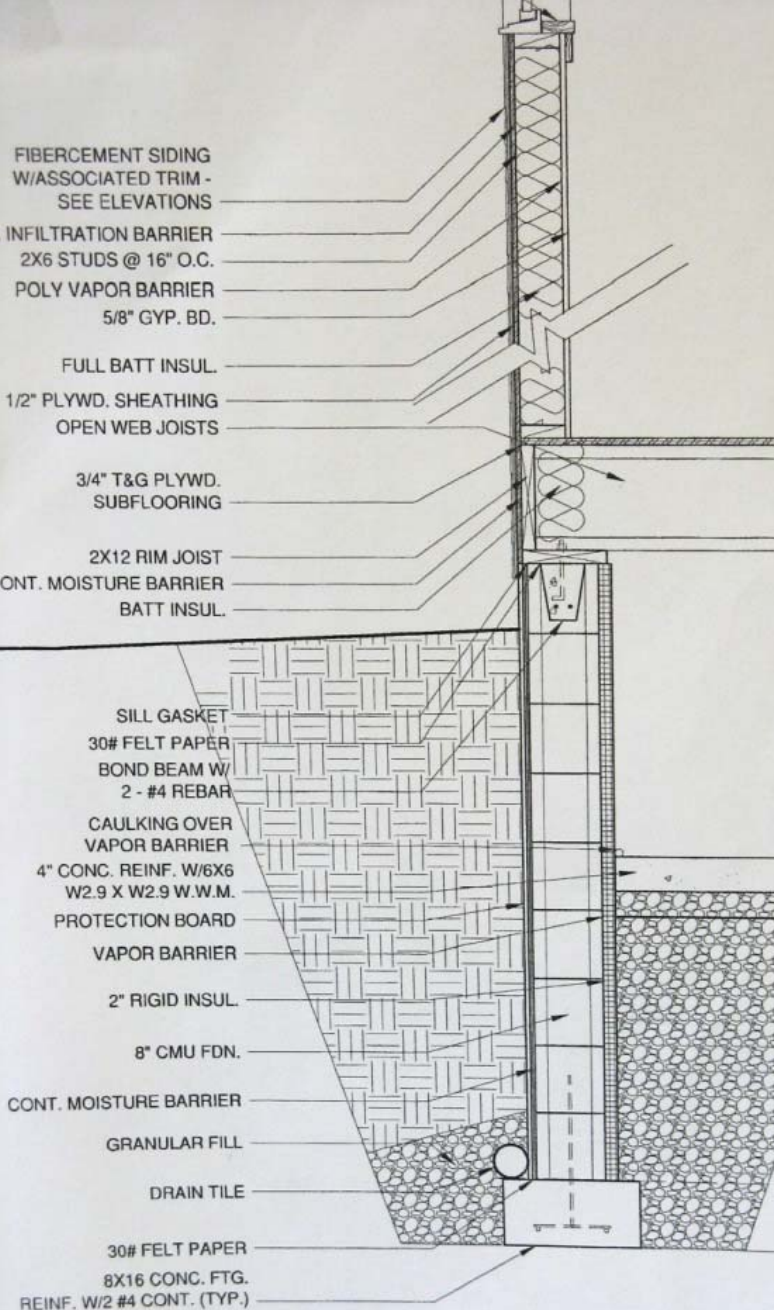






So what did we do?

- 1) Inspected all 20 homes with our blower door & infrared camera, performed visual inspections
- 2) Informally interviewed residents



9 WALL SECTION
 3/4" = 1'-0"

Date: 03-31
 Revised:
 Drawn by:
 Checked by:

BOIS FORTE LTD PARTNERSHIP #2 TRIBAL HOUSING PROJECT

LAKE VERMILLION / NETT LAKE

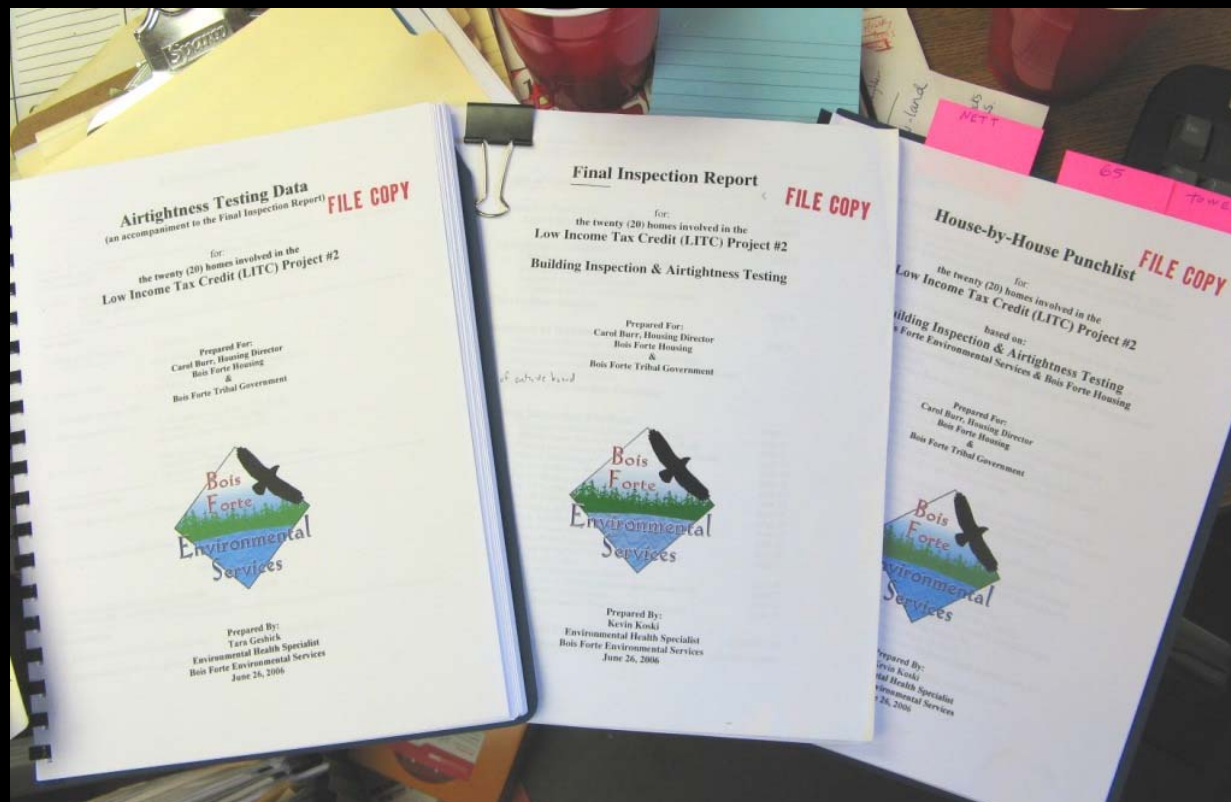
FIVE
 BEDROOM
 OPTION "B"

A2

3) Dug through:

- Architect's Drawings
- Project Specifications
- Contract Documents
- MN Codes

4) Prepared detailed and fully illustrated inspection report, including all inspection findings, infrared images, blower door data, code quotes, drawing & spec quotes, and punch list for renovation work



5) Attended planning meetings with Housing representatives, Tribal Council, and Tribal attorney

6) Sent reports out to Architect and General Contractor

7) Attended meetings with Tribal representatives, architect, Contractor and subcontractors

8) Approved scope of work for renovations

9) Supervised some of the renovation work













